Investigation of International Space Station Major Constituent Analyzer Anomalous ORU 02 Performance

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ABSTRACT:

The Major Constituent Analyzer (MCA) is a mass spectrometer-based instrument designed to provide critical monitoring of six major atmospheric constituents; nitrogen, oxygen, hydrogen, carbon dioxide, methane, and water vapor on-board the International Space Station. It is an integral part of the Environmental Control and Life Support System (ECLSS).

The MCA system is comprised of seven orbit-replaceable units (ORUs) that provide flexibility in maintaining the MCA. Of these, ORU 02, the analyzer assembly requires replacement every 1 to 2 years due to the consumption of limited life components including the ion pump and ion source filaments. Typically, ORU 02s that reach end of life are swapped out of the MCA on orbit and replaced with the on-orbit spare. The replaced ORU 02 is then returned to the OEM for refurbishment and is then return to service.

Recently, 2 refurbished ORU 02s, serial numbers F0001 and F0003, failed on orbit shortly after being installed into the MCA. Both ORU 02s have been returned to ground for TT&E, and a failure investigation is underway. The failure signatures have been reproduced on the ground and an initial investigation has determined that both ORU 02 failures involve either the ion source or the ion source control electronics.

This paper discusses the results of the failure investigation, the steps required to refurbish the ORU 02s, and the risk mitigation steps that are being incorporated into the refurbishment process to preclude the reoccurrence of these failures in the future.